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EXAMINER

OLSEN, ALLAN W

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| ART UNIT | PAPER NUMBER |
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1763

DATE MAILED: 09/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/917,549

Applicant(s)

RICHTER ET AL.

Examiner

Allan W. Olsen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 July 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities:

page 3, line 8 - "...or its reswherein..." requires correction;

page 9, line 25 - page 10, 5 - the phrase "the vertical removal corresponds at most to the etching rate of the organic antireflection layer" is not clearly understood by the examiner. Does this mean that the rate at which the photoresist is removed in vertical direction does not exceed the vertical etching rate of the organic ARC (or, the etching rate of the organic-ARC is greater than or equal to the etching rate of the photoresist)? This passage should preferably be amended to correspond to any amendment that is presented to overcome the 112 rejection of claim 7.

page 10, line 16 and page 16, line 23 - these passages should preferably be amended to correspond with any amendment made to overcome the 112 rejection of claim 8. The examiner notes that the specification parenthetically recites equivalent values with units of sccm. While sccm is not an SI unit it is nevertheless a much more widely used unit than the SI unit.

Page 19, line 3 - the chemical formula should use subscripts rather than superscripts.

Appropriate correction is required.

Claim Objections

Claim 10 is objected to because of the following informality: claim 10 includes an improper recitation of a Markush group, in that "or a Helicon source" should read --and a helicon source--.

Appropriate correction is required.

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Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 6-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "primarily" in claim 1 is a relative term which renders the claim indefinite. The term "primarily" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Does a "composition primarily containing hydrogen and nitrogen" require that these two components constitute at least 50 % of the composition? Or does it mean that no other component can be present in an amount greater than the amount of either hydrogen or nitrogen?

Claim 6 is directed to the inclusion of additives to the etchant. Claim 6 recites that the additives are "for improving etching gas properties in the dry etching process". What does that mean?

Claim 7 recites "the vertical removal corresponds at most to the etching rate of the organic antireflection layer" which is not clearly understood by the examiner. See above specification objection.

Claim 8 recites "and flow of the etching gases in a range between 0.17 and $1.67 \cdot 10^{-6} \text{ m}^3\text{sec}^{-1}$ ". The 10^{-6} does not appear to be associated with the 0.17.

Claim 9 includes mutually exclusive limitations in that it requires processing with magnetic field-assisted reactive ion etching while at the same time allowing for a magnetic field strength of 0 Gauss.

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Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,211,061 issued to Chen et al. (hereinafter, Chen).

Chen teaches etching an organic antireflection film with a plasma of H₂ and N₂.

See column 3, line 10-11 and column 6, lines 38-53.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen.

Chen teaches the limitations of independent claim 1 as noted above.

Additionally, Chen teaches using the patterned photoresist and patterned organic-ARC as a mask to etch an underlying hard mask layer. Chen teaches applying the

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photoresist to a depth a trench (35), which Chen teaches to be 4000-8000 Å. Chen teaches applying the organic-ARC with a thickness of 4000-8000 Å.

Chen does not teach using an etching gas composition such that the organic-ARC layer etches at a faster rate than the photoresist layer.

It would be obvious to use an etching gas composition that would etch the organic-ARC layer at a faster rate than the photoresist layer because Chen teaches that both layer are to used as a mask to etch the hard mask layer and that the photoresist and ARC layers have the same thickness. Therefore, in order for the photoresist to survive the etching of the ARC layer the ARC's etching rate must be greater than the photoresist's etching rate.

Chen does not teach using the flow rate and pressure parameters of claim 8.

It would be obvious to the skilled artisan to use the flow rate and pressure parameters of claim 8 because Chen teaches using reactive ion etching and these claimed values represent that which is typical for these parameters during reactive ion etching processes.

Chen does not teach using a MERIE, ECR, ICP or helicon plasma apparatus.

It would be obvious to one skilled in the art to use a MERIE, ECR, ICP or helicon plasma apparatus because each of these apparatus are known for providing a higher density plasma which provides for faster etching rates and high etching selectivity, as well as the ability to use a lower plasma source power which in turn reduces plasma damage to the workpiece.

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Furthermore, it is noted that the limitations of 3 and 7-9 pertain to flow rates, chamber pressure and magnetic field strength. Process parameters such as these are considered to be cause effective variables, which may be optimized through routine experimentation. As such, claims to specific values of such parameters cannot provide the basis for patentability.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ 233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Claims 6 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as applied to claim 1 above, and further in view of US Patent 6,114,250 issued to Ellingboe et al (hereinafter, Ellingboe).

Chen does not teach the nitrogen to hydrogen ratio in the etchant. Chen does not teach using a MERIE, ECR, ICP or helicon plasma apparatus.

Ellingboe, like Chen, teaches using a mixture of nitrogen and hydrogen to etch an organic layer. Ellingboe teaches using a 1:1 ratio of nitrogen and hydrogen. Additionally, Ellingboe teaches that the method may be used in conjunction with a variety of plasma reactors. See column 6, lines 28-34 and column 4, lines 45-55.

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It would have been obvious to one skilled in the art to use the inductively coupled reactor and the 1:1 nitrogen to hydrogen ratio of Ellingboe because in a method that provides excellent selectivity with respect photoresist and which promotes anisotropic etching, Ellingboe teaches that a high density, ICP is the preferred plasma system and also that the preferred amount of hydrogen is about 50% and the preferred amount of nitrogen is also about 50% (i.e., a nitrogen to hydrogen ratio of about 1).

Conclusion


The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent 6,372,636 (Chooi et al.) discloses several etchants, including nitrogen and hydrogen, that may be used alone or in combination to etch an organic-ARC layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 703-306-9075. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Greg Mills, can be reached on 703-308-1633.

The examiner's Right-Fax (direct to desktop) phone number is 703-872-9684. Alternatively, the general fax numbers for TC1700 are 703-872-9310 (non-after finals) and 703-872-9311(after-final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.
September 12, 2002


A.O. 1763